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Big Data – a Hype that has reached Finland or not?

Master's Thesis

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MASTER'S THESIS

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Summary

This master's thesis is about the Big Data phenomena globally and specifically in Finland. The main purpose of this study is to assess the current trend and maturity level of Big Data in Finland in 2015. A secondary purpose is to recognize and understand factors impacting the industries to adopt the technology.

The method to achieve the outlined purpose starts by exploratory research using the most relevant literature, reports as well as research works. It continues with an empirical qualitative research where a series of interviews has been conducted with a number of decision makers from sectors like ICT and manufacturing industries.

The result is that Big Data hype has reached Finland and it has already impacted some industries. The result illustrates the facts and figure of companies' perspective, trends and activities in relation to Big Data technology in Finland.

The conclusion of my study provides some advices and suggestions to the industries in general as well as the society.

Language: English Key words: Big Data, ICT, Strategy, Qualitative research

EXAMENSARBETE

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Handledare: Stefan Granqvist

Titel: Big Data - en hype som har nått Finland eller inte?

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Abstrakt

Det här examensarbetet handlar om Big Data fenomenet både globalt och specifikt i Finland. Huvudsyftet med studien är att utvärdera den nuvarande trenden och mognadsgraden av Big Data i Finland 2015. Ett annat syfte är att identifiera och förstå faktorer som är anledningen till att industrin vill införa denna teknologi.

Metoden för att uppnå syftet börjar med forskning i relevant litteratur, rapporter och forskningsarbeten. Detta följs av en empirisk kvalitativ undersökning där en rad intervjuer har genomförts med ett antal beslutsfattare.

Resultaten av studien är att Big Data hypen redan har nått Finland och har också redan påverkat en del branscher.

I studiens sammanfattning ger jag några råd och föreslag till hur industrier och samhället kan han nytta av Big Data synsättet.

Språk: Svenska Nyckelord: Big Data, ICT, Strategi, Kvalitativ forskning

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TABLE OF CONTENTS

LIST OF TABELS AND FIGURES

TABELS

FIGURES

APPENDICES

1 INTRODUCTION

This Master's thesis is part of the Master's Degree Programme in Technology Based Management at Novia University of Applied Sciences.

This study includes a theoretical and an empirical part related to Big Data research in Finland. *The theme is tailored for the management level in the industrial sectors.*

Big Data concept has been around for over a decade. The subject has become dominant in many technological forums and publications across the globe. Early adopters have already started getting the advantage of it. According to a recent survey by Gartner, released in September 2014, investments in Big Data technologies continue to expand and the survey reveals that 73 % of organizations have invested or plan to invest in Big Data in the next two years.

In Finland the current view is a bit different and the interest seems to be relatively low.
To capture a better understanding of the situation and the impact of Big Data and other digital technologies in different industries, by the end of 2013 Accenture conducted a market study interviewed more than 130 executives from the 40 largest Finnish companies and public organizations.

The report highlights the impact and criticality level of digitization including Big Data to any business. The report also stated companies' and organisations' concern regarding Big Data and they look for more assurance in aspect like the technologies authenticity, maturity level, adoptability, profitability and data privacy security issues.

The report demonstrated several examples of how Digital can create benefits for companies and organizations as: digital channels, cost efficiency and new products and services with a higher margin by means of a digital business.

Based on this report, Big Data and analytics are about breaking through and it is expected to change the world. The term of Big Data is relatively new for many people and few know how to leverage it.

The Accenture study's results indicate that Big Data and analytics have already impacted by 44 %. It is expected to increase to as much as 84 % within the next three years.

Business leaders and executives seek clear vision and pragmatic approach to it in order to be able to invest in it stated in the study. An energy industry representative even considers Finland to hold a leading position in the development of some analytics-related applications.

As a conclusion, Finnish business and companies are part of the world-wide economy. Customers expect Finnish companies to operate on the same level as world-class players.
I believe that this topic is very important to have deeper knowledge in and grasp a better understanding of the current state of art and what recommendation I can provide as a conclusion.

We know that Big Data hype has reached Finland, but not mature yet. In this study I will explore the technologies maturity level and adoptability trends in Finland and what are the concerns and doubts which make barrier for adoption in Finland.

For the theoretical part, I will study and explore a numerous of well-known literatures, researches, strategies, pragmatic experiences and use cases. For the empirical part of the study, a number of Business leaders and decision makers will be interviewed to get the understanding of their views and vision about Big Data technology.

Finally, as a result the goal is to achieve a realistic conclusion and set of advisory information that provide the answers and guidance to myself and to whom has similar interest in Big Data analytic in industries and the society (Accenture research on Finnish businesses and organizations, January 2014), (http://wwwgartner.com).

1.1 Background

Decision-making is part of our daily life on individual and organisational level. It is one of the main and important roles of the business leaders. The settings we live in today is generally the result of the decisions we made in the past and the decisions we make today will have implications in the future. Making the right decision in the right phase will make all difference and enabling one to remain competitive.

Business leaders and decision-makers have mainly relied on the traditional Business Intelligence (BI) techniques and tools for the transformation of raw data into meaningful and useful information for business analysis purposes and create new strategic business opportunities. These traditional solutions works fine to certain extend and has helped enterprises and decision to make a fact-based decision-making. Nevertheless, today´s competitive environment of increasing complexity, market competition and expanding data and information overload, enterprises need faster and better decision-making methods and pro-activeness in the business.

Big Data technology claims to be the solution and a revolution in business management and analytic space. Big data, the authors write, is far more powerful than the analytics of the past. Executives can measure and therefore manage more precisely than ever before. They can make better predictions and smarter decisions.

Big Data refers to datasets whose size are beyond the ability of typical database software and BI tools to capture, store, manage and analyse, according to McKinsey Global Institute. Gartner Analyst, Doug Laney defined data growth challenges and opportunities as being three-dimensional in his research report released in 2001 “3D Data Management” Controlling Data Volume, Velocity and Variety”. Gartner and now much of the industry, continues to use this "3Vs" model for describing Big Data. IBM has extended the attributes with one more dimension which is “Veracity”.

In the complex business environment and lifestyle we live today, we are surrounded with machine and human data triggers. According to computer giant IBM, 2.5 exabytes of data was generated every day in 2012. 90 % of world's data generated over the last two years. “About 75 % of data is unstructured, coming from sources such as text, voice and video," says Laurie Miles, head of analytics for Big Data specialist SAS.

Data scientists and analysts can link and process these data and turn it into valuable information and insights for new business opportunities and better predictions. The idea behind Big Data technology aims to break-through the limits and represents a new era for data-driven society and decision-making in almost on a real-time basis.

Big Data hype intensified in the recent years and reached the *Peak of Inflated Expectations* in the Gartner Hype Cycle. The topic draw analyst's attention world-wide and has been a hot topic in many forum and publications. Furthermore, the subject is perceived differently from country to country and industry to industry. The key question is, what is state of Big Data hype in Finland today? (http://digital.mit.edu), (http://en.wikipedia.org/), (http://www.bbc.com/).

1.2 Purpose

The purpose of this thesis is to conduct a theoretical and an empirical qualitative research about Big Data technology trend and maturity level in Finland. The secondary purpose is to recognize and understand factors impacting on industries adopting the technology.

1.3 Limitation

The limitation of this study is to conduct basic trend study on Big Data technology in Finland as is currently. It is dedicated for business management level. The target group in the empirical part was restricted to 10 companies in Southern Finland and representing ICT and manufacturing. I have no resources to carry out an investigation consisting of a large number of companies representing many industries (compare to the Accenture study in 2014).

1.3.1 The sectors I am especially interested in

The scope in this study is mostly linked to ICT Technology and manufacturing in Finland.

1.4 My thesis

I mean Big Data Hype has experienced slow acceptance in Finland. Private or public sectors have not been so keen to adopt the technology and invest in Big Data strategy, in contrast to countries like USA and India where the subject has been dominating for years.

It is essential to understand the business leader's perspective and concerns regarding the technology. It is also important to know the reason behind the lack of interest to adopt the technology, aren´t we ready for this? Or the technology is not mature enough to gain our trust? As an IT engineer in a management position I see this subject as very important and timely to investigate. The goal is to achieve a better understanding and results in order to be able to contribute with new insights to me and the society.

1.5 Terminology

I am parenting the central terminology;

- **4Vs:** IBM data scientists break Big Data into four dimensions: *volume; variety; velocity and veracity.*

- **BI:** Business Intelligence is a set of methodologies, processes, architectures and technologies that transform raw data into meaningful and useful information used to enable more effective strategic, tactical and operational insights and decision-making.

- **MIS:** Management information system.

- **Hype Cycle:** The Hype Cycle is a branded graphical tool developed and used by IT research and advisory firm Gartner for representing the maturity, adoption and social application of specific technologies.

- **ROI:** Return on investment (ROI) is the benefit to the investor resulting from an investment of some resource.

- **CDI:** Collaborative Data Infrastructure.

- **EUDAT:** European Data Infrastructure.

- **NRI:** Networked Readiness Index (http://www.yourdictionary.com/), (http://www.ibmbigdatahub.com).

1.6 Disposition

This thesis is divided into seven chapters. The first chapter is the introduction of the subject and defines the purpose, scope and limitation as well as the main questions which led to initiate this research.

The second chapter starts with theoretical research and it begins to explore the world history timeline and the time-frame we are living in modern history. It also gives an overview of Management information system (MIS) and Information age. Moreover, the theoretical research continues to focus on Big Data concept and its progression globally and specifically in Finland.

The third chapter presents the central literature on the field. It discusses the essential books and other literature I used for this study.

The fourth chapter discuss the underlying tools and technologies of Big Data analytic. The empirical part of the study is presented in chapter five which includes the details and results of the field research.

Chapter six provide suggestions and guidance for further research on Big Data field. Chapter seven presents the conclusion of the study.

Next I move on to chapter two to start with the theoretical research and trying to find some answer to the key questions.

2 IN WHICH AGE DO WE LIVE 2015?

The world history timeline is broken down into different time periods. In accordance with the Gregorian calendar (Western calendar), which is currently in use today we are living in the 21st century of the Anno Domini era or the Common Era, in. It began on January 1st, 2001 and will end on December 31st, 2100.

Based on the historiographical approach to the timeframe we are living in Modern history, it began from 1500 AD to present day. The French Revolution and the Industrial Revolution represent the millstone that further breakdown the timeline of modern history into the early and the late modern period. Contemporary period describes the period timeframe that closely connected to the present day; it is a certain perspective of modern history. In contemporary science and technology, history especially includes spaceflight, nuclear technology, laser and semiconductor technology and the beginning Information Age (http://en.wikipedia.org/).

2.1 Age development and trend, 1800 – 1900 – 2000

The 19th century (1800 – 1900) witnessed the rise of modern industry. From Western Europe to Britain to North America. It was an era of rapidly accelerating scientific discovery and inventions, with significant developments in industrial manufacturing and technology-intensive services. The Industrial Revolution (1880–1945) was the transition to new manufacturing processes. This transition included going from hand production methods to machines, new chemical manufacturing and iron production processes, improved efficiency of water power, the increasing use of steam power and the development of machine tools.

The progression in the fields of mathematics, physics, chemistry, biology, electricity and metallurgy laid the groundwork for the technological advances of the 20th century.

The 20th century (1900 – 2000) saw a major shift in the way that many people lived, with changes in politics, ideology, economics, society, culture, science, technology and medicine. The global-scale conflicts between world powers across continents and oceans in World War I and World War II, were actually one of the key motivator to the countries and nations to gain more power and domination through technology and science.

It is interesting to think about what humanity can do within 100 years. The 20th century may have seen more technological and scientific progress. It started with horses and simple automobiles but ended with high-speed rails, cruise ships, global commercial air travels and the space shuttles.

The variety of home appliances increased dramatically such basic appliances as washing machines, refrigerators, electric stoves and vacuum cleaners all became popular from the 1920s through the 1950s. Radios were commercialized during the 1920s, which extended to television during the 1950s. Cable television spread rapidly during the 1980s. Personal computers began to enter the home during the 1970s–1980s as well.

The first airplane was flown in 1903. With the engineering of the faster jet engine in the 1940s, mass air travel became commercially viable. In 1960s computing hardware started to take lift as transistor and integrated circuit (IC) which was the beginning of Digital Revolution and digital record keeping that continues to the present day (http://en.wikipedia.org/).

2.2 Management information system (MIS)

Management information systems (MIS) and Big Data have strong interconnection with each other. An MIS has been defined "An integrated user-machine system for providing information to support operations, management and decision-making functions in an organization. The system utilizes computerized and manual procedures; models for analysis, planning, control and decision-making; and a databases" (Davis, G.B., 1985).

The practice of Information management possibly dates from the mid of 1950s. The field of MIS emerged about a decade after through the teachings and writings of scholars such as C. W. Churchman, G. B. Davis, B. Langefors, E.

MIS help organizations in any size gain maximum benefit from investments in personnel, equipment and business processes. MIS is people-oriented, with an emphasis on service.

The MIS receives data from company units and functions. It is programmed in such a way that it produces regular reports on operations for every level of management in a company. It is usually also possible to obtain special reports from the system easily. The main purpose of the MIS is to give managers feedback and overview about their own performance; top management can monitor the company as a whole.

An MIS can collect nearly any type of information managers require. They can view financial data such as daily revenues and expenses at a glance and feature them to specific departments or groups. Performance indicators such as the suitability and course of projects or the quality of products coming off an assembly line can help managers pinpoint areas of needed improvement.

Information systems can support a variety of management decision-making. These include the three levels of management activity: strategic management, tactical management and operational management (Wendy Robson 1997, pp 81), (Robert D 2011, pp 12-14), (http://www.fao.org).

2.2.1 MIS, Downsides and Risks

A management information system can be a costly investment. Risk reflects the potential, the probability, or the expectation of events that could unfavourably affect earnings or capital. Management uses MIS to help in the assessment of risk within an organisation. Ineffective, inaccurate, or incomplete MIS may increase risk to the management's faulty dictions in a number of areas such as credit quality, liquidity, market/pricing etc. Imperfect MIS causes operational risks and can badly affect an organization's monitoring of its consumer, Bank Secrecy Act, or other compliance-related activities.

MIS risk can extend to all levels of the operations since MIS is management's information access channel to assess and monitor performance at all levels of the organization. Poorly programmed or non-secure systems in which data can be manipulated and/or systems requiring ongoing repairs can easily disrupt routine work flow and can lead to costly implications.

There are five elements in MIS systems must be useable and reliable for the management and whole organisation which uses an MIS. The five elements of a useable MIS system are: timeliness, accuracy, consistency, completeness and relevance. There is no usefulness of MIS whenever one or more of these elements is compromised.

Examples on Management Information Systems:

- System Centre Configuration Manager - Microsoft
- Tivoli Framework – IBM
- IBM Information Management System (IMS) (Comptroller's Handbook, 1996, pp 1-5), (http://en.wikipedia.org).

2.3 Information age, 1900

The Information age, is the current period of time in human history. According to Wikipedia it is characterized of the current period based on the widespread of emerging information and communication technologies. It is also called the Computer Age or the Digital Age, which is related closely with the widespread and dependency of personal computers, Internet and communication technologies.

Human interaction with Information exchange and communication means has a long history back to 3000BC. But the first modern information revolution began in the mid-nineteenth century as the revolution primarily enhanced communications evolved technologies such as the telegraph, telephone and radio during the time.

This led to the birth of digitalization and computer age, as the history trace its beginnings to the work of the American mathematician Claude E. Shannon (Father of information Age). He is credited with founding both digital computer and digital circuit design theory in 1937. Shannon was 21-year-old master's degree student at the Massachusetts Institute of Technology (MIT), he wrote his thesis demonstrating that electrical applications of Boolean algebra could construct and resolve any logical, numerical relationship.

Shannon's passion to the subject evolved in 1948 at age 32 and as a researcher at Bell Laboratories, Shannon published a breakthrough paper proposing that information can be quantitatively encoded as a series of ones (1) and zeroes (0). He is known with

“Information Theory” where he showed how all information media, from telephone signals to radio waves to television, could be transmitted without error using this single framework. He did most of his pioneering work in the 1940s and 1950s, but the real-world impact of his research is widespread more than ever today than it was fifty years ago.

Shannon also developed the Information theory to find fundamental limits on signal processing operations such as compressing data and on reliably storing and communicating data. The key measure of information is **entropy (*H*),** which is the average number of bits needed to store or communicate one symbol in a message.

The driving force behind the enablers of the Information Age: semiconductors, computers and satellites, some of the primary technologies of the second modern information revolution. All these came from the massive investment United States put in its scientific and technological infrastructures, particularly those segments related to national defence during the 1950s.

The second modern information revolution extended from the mid-twentieth century until perhaps the 1980s. During this period, technologies such as television, early generation computers and satellites linked the world together in ways never seen before.

By the late 1980s, another information revolution emerged, information and communication technologies got the lift by semiconductors, computers, fibre optics and Internet. At this point in history analysts began to describe the rapidly approaching 21st century as "the Information Age”.

The Internet and Information Society is also considered to be the essential futures of Information Age. Since the mid-1990s, the Internet has had a revolutionary impact on societies, culture and commerce. In fact Internet was developed during the 1970s. Tim Berners-Lee, a British computer scientist and former CERN employee (The European Organization for Nuclear Research). On 12th of March, 1989, Berners-Lee wrote a proposal for what would eventually become the World Wide Web. The 1989 proposal was meant for a more effective CERN communication system but Berners-Lee eventually realised the concept could be implemented throughout the world (David S. 20054, pp 36), (Gurdev Singh, 2013, pp 312), (http://en.wikipedia.org).

2.4 The correlation between Data, Information and Knowledge

Data, information and knowledge are closely related terms, but each has its own role in relation to the other. Understanding the interconnections between Data, Information and Knowledge gives us a new insight and better understanding the fundamentals of Big Data concept.

The terms have different definitions depending on the context, following are some differences and definitions of the terms:

- Data is raw, unorganized facts that need to be processed. Data that the computer has processed into a useful form is called information. Data can be something simple and superficially random and useless until it is organized. Another definition is; Data is collected and analysed to create information suitable for making decisions.

- Information is processed, organised or classified data which has some meaningful values for the receiver. Another definition is; Information is "knowledge communicated or received concerning a particular fact or circumstance." Information is a sequence of symbols that can be interpreted as a message. It provides knowledge or insight about a certain matter. Information can be recorded as signs, or transmitted as signals.

- Knowledge is derived from extensive amounts of experience dealing with information on a subject. It is knowledge communicated or received concerning a particular fact or circumstance (Gurdev Singh, 2013, pp 312).

2.5 Data as a central asset

It is important to be able to distinguish between different kinds of data, because their nature has important implications for their reliability and for the sort of analysis to which they can be subjected.

Primary data is the Data that have been observed, experienced or recorded close to the event are the nearest one can get to the truth. Our senses deal with them like, sounds, vision, taste, etc. Tools and instruments also help to keep track.

There are many ways for collecting and recording primary data. Some are more reliable than other. Written sources that interpret or record primary data are called secondary sources e.g., news broadcasts, magazines, newspapers and internet.

Data can be further broken down into two categories which are qualitative and quantitative. Qualitative data can be observed but not measured and deals with aspects that may be observed by the senses, i.e. colour, texture, smell, taste, appearance, etc. Quantitative data is data that deals with numbers and can be measured. Criteria such as length, height, area, volume, weight, time, temperature, speed, cost, age, etc. are all considered quantitative in nature.

For data to become information, it must be analysed, contextualized, categorized, calculated and condensed (Davenport & Prusak 2000). Information is "knowledge communicated or received concerning a particular fact or circumstance. Information thus paints a bigger picture; it is data with relevance and purpose (Bali et al 2009). It may convey a trend in the environment, or perhaps indicate a pattern of sales for a given period of time. Essentially information is found "in answers to questions that begin with such words as who, what, where, when and how many" (Ackoff 1999).

IT is usually invaluable in the capacity of turning data into information, particularly in larger firms that generate large amounts of data across multiple departments and functions. The human brain is mainly needed to assist in contextualization.

Data is now seen as an essential enterprise asset. Data is seen as a fact, all transaction happens within organisations seen as data or fact. Moreover, data has become the key enterprise asset for many companies business and decision-making resources.

Managing data properly has therefore become important and there are a number of well-developed platforms, processes and processes for this purpose which will be described below (Deborah Morley, 2014), (Nicholas Walliman, 2013, pp 136 -138).

2.5.1 Data lifecycle management

Data Lifecycle management is a policy-based process of managing the flow of an information system's data throughout its lifecycle. Data life cycle refers to all the stages from creation till disposal of data (storage). By managing information properly over its lifetime, organizations are better positioned and well-equipped to deliver competitive offerings to the market quicker and support business goals with less risk.

DAMA (the Data Management Association) is an international association of technical and business professionals established specifically to promote the practice of data resource management (DRM) and advancing the concepts and practices of information resource management (IRM). DAMA's primary purpose is to promote the understanding, development and practice of managing information and data as a key enterprise asset.

A team of data management professionals from the Data Management Association produced "The DAMA Guide to the Data Management Body of Knowledge" (DAMA-DMBOK Guide). This guide is compilation of data management principals and best practices. The guide outlining the ten data management functions, see the DAMA-DMBOK Functional Framework v3 in figure 1 as follows:

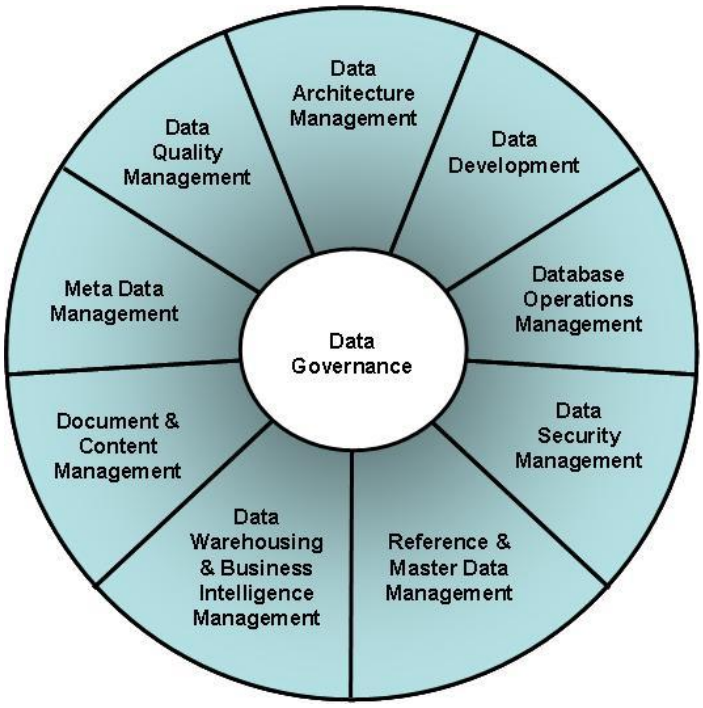

Figure 1. Data Management Functions (dama-dach.org)

The emergence of Big Data creates growing amounts of data, is another factor for the need for effective data lifecycle management. An example, IBM InfoSphere Platform provides all the foundational building blocks of trusted information, including data integration, data warehousing, master data management, Big Data and information governance.

Data Lifecycle Management solutions from IBM InfoSphere help address these challenges by:

- Reducing Costs: Lower infrastructure and capital costs, improve productivity and reduce application defects during the development lifecycle.
- Reducing Risks: Reduce application down time, minimize service and performance disruptions and meet data retention requirements.
- Promoting Business Agility: Improve time to market, increase application performance and improve quality of applications through realistic test data (http://en.wikipedia.org), (http://www-01.ibm.com), (http://www.dama.org/).

2.6 Big Data essentials

The strategic value of Data have become a new form of asset class today due to the magnitude of high volume, high velocity, high variety and the available capability to process them. In a very real sense, data are now the equivalent of oil or gold. This is what everyone is looking for and this is why Big Data today gets so much attention.

According to computer giant IBM, 2.5 exabytes - that's 2.5 billion gigabytes (GB) - of data was generated every day in 2012. That's big by anyone's standards. About 75 % of data is unstructured, coming from sources such as text, voice and video and it is expanding on three fronts at an increasing rate, see figure 2 as follows:

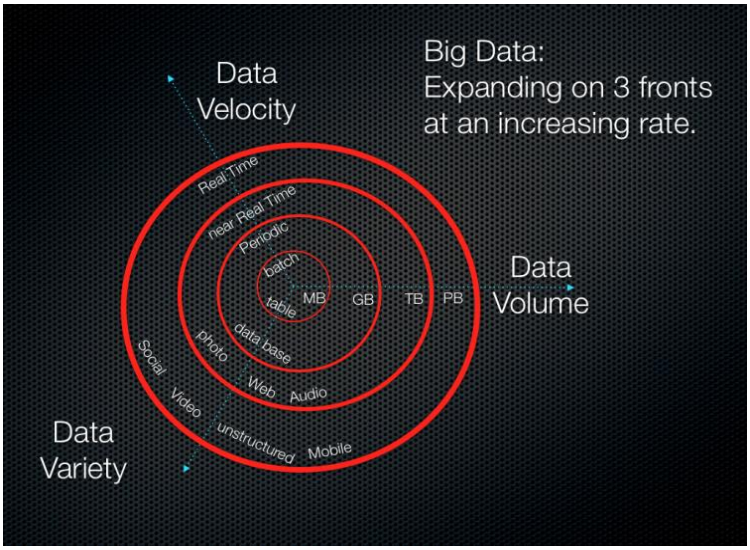

Figure 2. Big Data expansion 3Vs (datascience-central.com)

Big Data has arrived. It is changing our lives and changing the way we do business. But succeeding with Big Data requires more than just data. Data-based value creation requires the identification of patterns from which predictions can be inferred and decisions made.

Businesses need to decide which data to use. The data each business owns might be as different as the businesses themselves; these data range from log files and GPS data to customer- or machine-to-machine data. Each business will need to select the data source it will use to create value. Moreover, creating this value will require the right way of processing and then analysing those data with the right analytics. It will require knowing how to separate valuable information from hype.

This world of Big Data has also become a source of concern. The consequences of Big Data for issues of privacy and other areas of society are not yet fully understood. Some prominent critics, such as Jaron Lanier, call on us to be cautious about readily believing any result created by the "wisdom of the crowd". We are just at the beginning of a long journey where, with the proper principles and guidelines, we should be able to collect, measure and analyse more and more information about everyone and everything in order to make better decisions, individually and collectively (The Global Information Technology Report, 2014), (http://www.bbc.com).

2.7 Big Data Globally

Big Data has a long history, which has historical roots to Sumer which is located in Mesopotamia. They used to clay tablets as a writing and data storing medium by scribes. The royal Library of Ashurbanipal was built and collected thousands of clay tablets and fragments.

As a reference example, in 1908, on the island of Crete, archaeologists discovered a clay disc, see figure 3. They dated it from 2000 B.C., so it's 4,000 years old. Now, there's writings and symbols on this disc. It's a complete mystery what are these writings describes, but the point is that the society 4,000 years ago knew the real value of information, the importance of managing it and storing it for a long time.

Figure 3. The Phaistos Disc (wikipedia.org)

Today, in the era of Information age, data and information is everywhere and we all became as data scribes because we leave traces of our activity. All the digital devices available now which collect these data from credit bureau agencies, telecom operators, weather streams, sensors and social media. Once we mashup and draw all these traces in a pattern, we can reveal interesting insights and predictions about our health, business, economy etc (https://www.ted.com), (http://dataconomy.com).

Google Trends

The concept of Big Data in some countries is well-known and it has taken extensive growth phase; in other countries the concept is still new or unknown. As it appears in **Google Trends,** see figure 4, the interest over time worldwide seems to be in low and steady rate throughout 2000 – 2011, then it started to increase significantly until today.

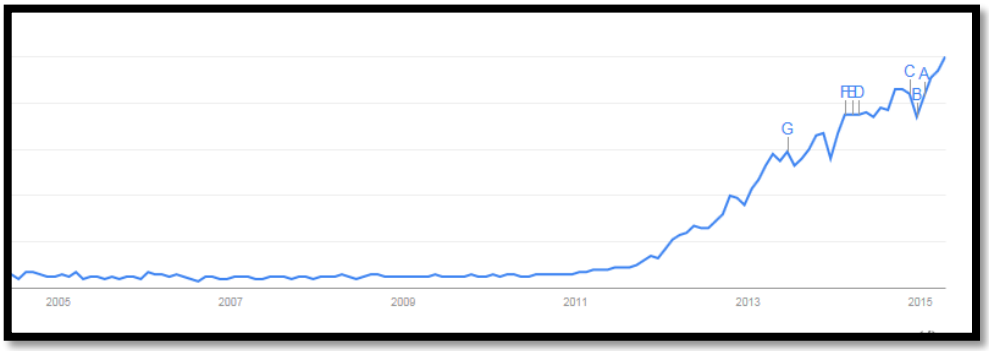

Figure 4. Big Data interest over time worldwide (google.com)

The Regional Interest in Google trends in March 2015, see figure 5, shows that high interest in USA, India and East Asia and Australia.

Figure 5. Big Data Regional Interest (google.com)

2.7.1 IBM Business Tech Trends study

In August 2014 IBM launched the results of its Business Tech Trends study where they surveyed 1400 decision makers in 15 industries 13 countries to get a current snapshot of how companies are using the key technologies and business models. This study examines the adoption, investment and skills gaps by country for the four technology areas including Big Data and analytics.

The study shows that technologies like Big Data analytics, cloud, mobile and social technologies are on the mainstream and companies have already adopted the technology or planning to adopt it in a few years.

The study also presents the percentages of enterprises deploying Big Data and Analytics as well as the percentages planning to increase investment over the next two years, see table 1 as follows:

Enterprises deploying Big Data & Analytics		Enterprises increases investment over next two years	
Worldwide	75 %	**Worldwide**	76 %
US	82 %	**US**	81 %
India	82 %	**India**	85 %
China	81 %	**China**	90 %
France	80 %	**France**	62 %
Brazil	79 %	**Brazil**	69 %
Italy	79 %	**Italy**	73 %
Mexico	78 %	**Mexico**	67 %
UK	77 %	**UK**	74 %
Spain	76 %	**Spain**	54 %
Russia	76 %	**Russia**	72 %

Table 1. Adoption & investment by country in Big Data (ibmcai.com)

Since the 2012 Tech Trends study, Big Data & Analytics deployment has grown by 39 %, deploying a significant range of Big Data & Analytics solutions capabilities.

According to the study enterprises in USA and East Asia are leading the adoption and Investment in Big Data & Analytics as well as other technologies. This figures in this study match the indications of regional interest in Google trends I showed above.
The report illustrate also the adoption levels by Industry, see figure 6 as follows:

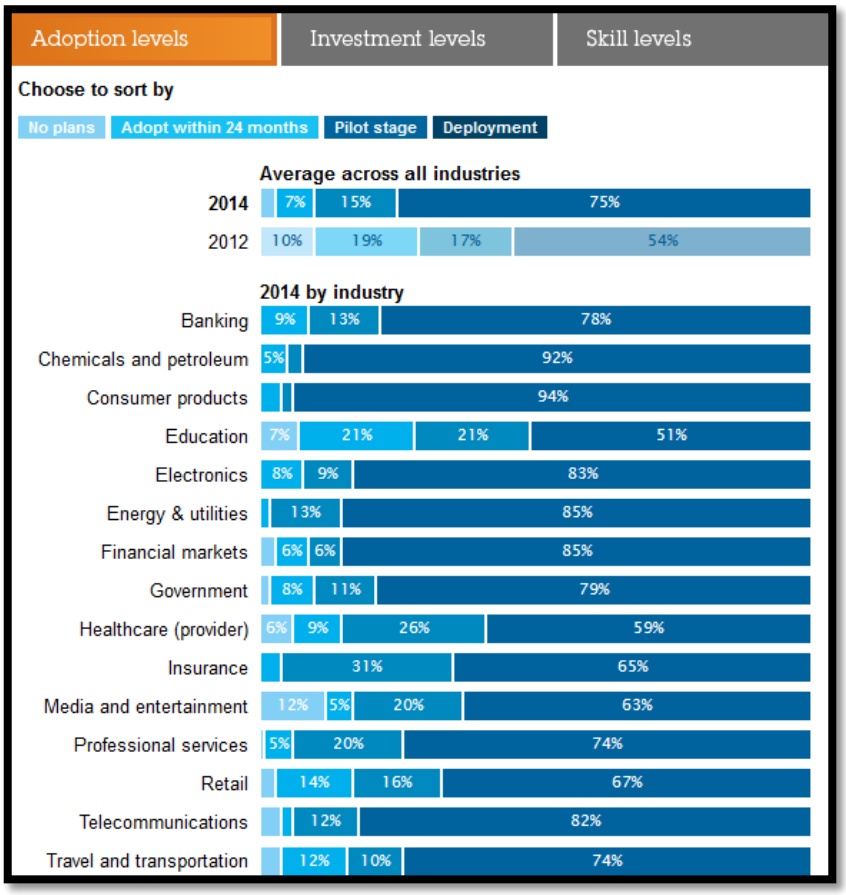

Figure 6. Adoption levels by Industry (ibm.com)

In average, currently 75 % already adopted and deployed the technology. 15 % is in pilot stage and 7 % planning to adopt in 24 months and only 3 % has no plans. This means that in average 97 % across all industries will adopt Big Data technologies in 24 months in the countries the study took place (http://www.ibm.com).

2.7.2 Gartner Hype Cycle Report

Gartner released in August 2014 its latest Hype Cycle for Emerging Technologies. Last year, Big Data reigned supreme, at what Gartner calls the "peak of inflated expectations." But now Big Data has moved down the "trough of disillusionment," replaced by the Internet of Things at the top of the hype cycle. In 2012 and in 2013 Gartner's analysts thought that the Internet of Things had more than 10 years to reach the "plateau of productivity" but this year they give it five to ten years to reach this final stage of maturity, see figure 7 as follows: (http://www.gartner.com).

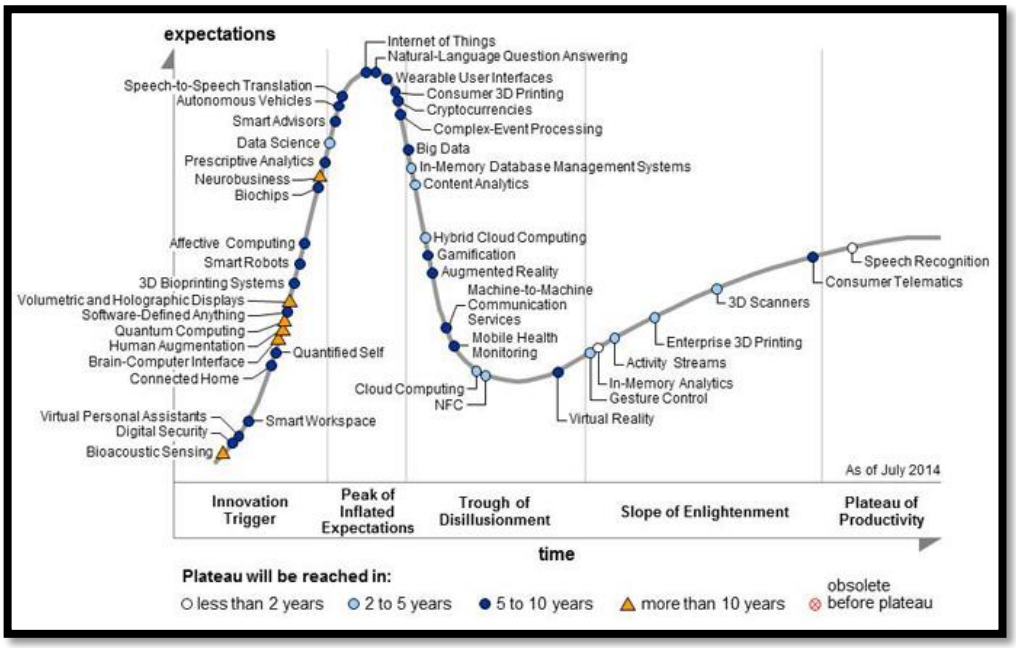

Figure 7. Gartner Hype Cycle 2014 (gartner.com)

2.7.3 Organizational Structures and Skills

As with technology architectures, organizational structures and skills for Big Data in big companies are evolving and integrating with existing structures, rather than being established a new. No organization we interviewed has established an entirely separate organization for Big Data; instead, existing analytics or technology groups have added Big Data functions to their missions. Others simply say that they are adding data science capabilities to their existing portfolios.

The organizations whose approaches seemed most effective and likely to succeed had close relationships between the business groups addressing Big Data and the IT organizations supporting them.

In terms of skills, most of these large firms are trying to expand their existing analytical staff with data scientists who possess a higher level of IT capabilities and the ability to manipulate Big Data technologies specifically. These might include natural language processing or text mining skills, video or image analytics and visual analytics. Many of the data scientists are also able to code in scripting languages like Python, Pig and Hive. In terms of backgrounds, some have Ph.D.'s in scientific fields; others are simply strong programmers with some analytical skills (Davenport, 2014).

2.7.4 Developing Big Data strategy

Developing the right Big Data strategy for any organisation that consider to adopt Big Data technology is one of the most important steps for success in the mission. You need to have joined assembly with your senior management team and start talking about what Big Data can do actually for your company. The process need serious thinking where Big Data fits into your business and what are the objectives you want Big Data to fulfil. After that there is plenty of time to pursue technologies, tools and other tactical steps. Decision maker need to really understand the opportunities available from a data perspective. Big Data enable you to use and analyse plenty of unused data for the first time and fast which could have a large impact on the business.

Big Data Objectives

The technology behind Big Data allow organisations to achieve a variety of objective with the right plan and execution. The primary objectives are the following:

1. Cost Reduction
2. Time Reduction
3. Faster decision
4. Better decision
5. Product/ service innovation and improvement

Deciding what the organisations wants from Big Data is a critical decision that has implications for the outcome, financial benefits and for the process – who leads the initiative, where it fits within the organisation, how you manage the project (Davenport 2014, pp 59-80).

Approach for Big Data Adoption

You should follow conservative approach if:

- Your competitors are not doing much with Big Data.
- Technology has not driven industry transformation in the past.
- You do not have much data on customer or on other important business entities.

You should be moderately aggressive with Big Data if:

- Your industry already active in Big Data or analytics.
- You want to stay ahead of your competitors.
- Your company is typically facile with technology and data.
- You have some people who can do Big Data work.

You should be very aggressive if:

- Someone in your industry already being very aggressive.
- You have been analytical competitor in the past.
- You have used technology to transform your industry in the past.
- You have assembled all the necessary capabilities (Davenport 2014, pp 59-80).

2.7.5 Use cases

Companies like GE, UPS and Schneider National are increasingly putting sensors into things that move or spin and capturing the resulting data to better optimize their businesses. Even small benefits provide a large payoff when adopted on a large scale. GE estimates that a 1 % fuel reduction in the use of Big Data from aircraft engines would result in a $30 billion savings for the commercial airline industry over 15 years. Similarly, GE estimates that a 1 % efficiency improvement in global gas-fired power plant turbines could yield a $66 billion savings in fuel consumption. UPS has achieved similarly dramatic savings (see the "Big Data at UPS" case study) through better vehicle routing (Davenport 2014, pp, 24-25).

Etihad Airways is the flag carrier of the United Arab Emirates using Big Data to help with safety and passenger satisfaction. The algorithm Etihad is using also allows them to perceive their level of growth and potential popularity among passengers in the years to come.

One of the insurance companies implemented Big Data analytic technology for Fraud prevention which reduced losses and increased efficiency. Time reduction for Claims and investigation by 95 % and ROI achieved 403 % within three months (https://datafloq.com).

2.7.6 IBM Big Data use cases:

IBM identified the top five areas that capture the most Big Data use cases that different industries are focusing on and investing in.

- **Big Data Exploration**

  Explore, find, visualize and understand all Big Data to find what is interesting and relevant to the business for better decision-making.

- **Enhanced 360º View of the Customer**

  Optimize every customer interaction by knowing everything about them. Gain a better understanding of customers' behaviour e.g., why they buy, how they prefer to shop, what they will buy next and what factors lead them to recommend a company to others.

- **Security Intelligence Extension**

  Enhance traditional security solutions to stop crime by analysing all types and sources of Big Data. Lower risk, detect fraud and monitor cyber security in real-time (e.g., social media, emails, sensors, telecommunication).

- **Operations Analysis**

  Apply analytics to machine data for better operational efficiency. Apply predictive models to identify potential differences, combine information to understand service levels, monitor systems to avoid service inefficiency or outages.

- **Data Warehouse Modernization**

  Integrate Big Data and data warehouse capabilities to increase operational efficiency. Optimize data warehouse capacity to enable new types of analysis (http://www-01.ibm.com).

2.8 Big Data in Finland 2014

Big Data is relatively new concept in Finland and it is not well-known like other technologies. A part of that there are a number or early adopters, growing interest and initiatives from private and public sectors to study and adopt the technology.

In the fall of 2013, Accenture interviewed more than 130 executives from the 40 largest Finnish companies and public organizations to create a better understanding of the impact of digital in different industries. Accenture released the study report in January 2014, the report emphases and highlights the impact and criticality of digitization to any business. In another word, it is no longer an option, but critical to any business.

It seems companies in Finland has been resistant to all Big Data hype and publication has been in the media channels. There naturally good reason for this, including the maturing level of the technology, data privacy and security issues.

The statics results indicate that Big Data and analytics have already impacted by 44 %. It is expected to increase to as much as 84 % within the next three years, see figure 8 as follows:

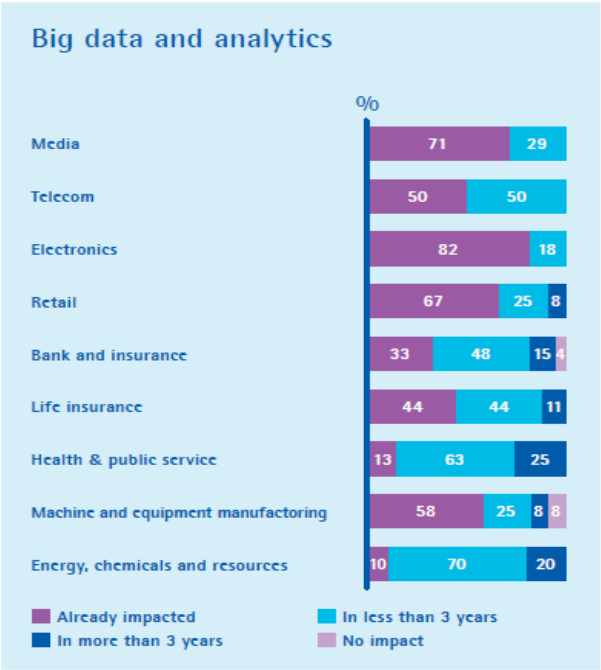

Figure 8. Big Data impact on industries (Accenture study 2014).

Another report published by Accenture on September 16, 2014, the report shows new progress in the perception to Big Data by the companies in Finland and abroad. According to Björn Hortling, Accenture, commercial and industrial analytics, Senior Vice President in Finland companies have now reached the point where you no longer talk about Big Data's potential benefits, but to achieve real benefits, such as revenue growth, increased customer loyalty and improved efficiency of operations. "Companies have realized that Big Data is one of the cornerstones of digitization".

According to the survey of companies, operational areas will be the greatest business benefits. The study mentioned that Big Data has improved the company's business in finding new sources of income and improving the customer experience. Finland is at the forefront of the new sources of income in respect of 48 % and the customer experience in respect of 44 %. On the other hand, 73 % of Finnish executives believe the Big Data significantly affect the organization's customer relations over the next five years.

Finnish companies mentioned greatest challenge of the shortage of Big Data experts 51 %. The security challenge was 35 % and 37 % of the cost. These data are shown in a recent Accenture's global Big Data Survey, which was attended by companies from seven different industries and 19 countries, including Finland.

Companies are becoming increasingly aware that they are sitting on huge amounts of under-utilized data and looking for ways to increase its value. The conditions for data monetization are ripe: massive volumes of structure and unstructured data; decreasing storage costs; data-driven marketing campaigns that create relevant customer experiences; and improving business intelligence and processes by applying data analytics.

In a press release in August 2014 Krista Kiuru, Minister of Education and Science in Finland pointed out that Big Data provides Finland with many opportunities, but its utilization requires extensive cooperation. And the utilization of Big Data sets is still relatively rare and availability of competent individuals is a challenge (Accenture study, 2014), (http://www.lvm.fi), (http://www.accenture.com).

2.9 Big Data trends and readiness in Finland

When I started to search for information about Big Data in Finland for the aims of this study I realized the amount of the relevant information was none or quite few and very limited. Thus, did not serve the study and I needed to change the searching method as it gave fairly good results and enabled me to make very good connections with the key people on Big Data field in Finland. However, my impression started to change after a while when I found the leads and sufficient information about interesting projects and initiatives actually has taken place in Finland on Big Data.

The matter of fact is a segment of people and organisations in Finland has already taken the lead by different initiatives and projects in Big Data space and they started to pave the way for other. Some of the investment and collaborations on Big Data in Finland are the following:

- Big Data exploitation; A National Big Data-strategy proposal developed by Big Data working group from the Finnish Ministry of Transport and Communications.
  This is the one of the most comprehensive reports I came across specific to Big Data in Finland.

  The goal of the strategy is the widespread and progressive use of large datasets that will promote economic growth and transparency in society. The approach emphasises the diversified and multidisciplinary qualities of data exploitation as well cooperation and the transparency of data. The strategy identifies potential application areas for data utilisation and development with regard to innovations.

  In the report, proposes actions related to the requirements for development and the application areas for Finland. In line with the strategic goal, these actions will be targeted at a more extensive use of data both by the public sector, business life, researchers and individual users (http://www.lvm.fi).

- The Ministry of Education has invested through CSC – IT Centre for Science in state of the art solutions like fast networks transmission, tiered computing, scientific applications, information management, data services as well as expert support. Also EUDAT's services. The EUDAT project aims to contribute to the production of a Collaborative Data Infrastructure (http://www.datanami.com).

- CSC – IT Centre for Science offers European Data Infrastructure´s service (EUDAT). It is the European Collaborative Data Infrastructure (CDI) for European researchers and practitioners from any research discipline to preserve, find, access and process long-tail and Big Data in a trusted environment. "EUDAT provides a European extension to the Finnish national data services and supports Finnish researchers' involvement in cross-national collaborations" (https://www.csc.fi).

- Polytechnics and universities are responding to the recognized lack of experts in Big Data by starting new programs and cooperation with companies e.g., Aalto University and University of Tampere.

- Nokia Networks Big Data innovation promises dynamic experience management.

- Ivorio Oy as a consultancy company, specialized in concepts of Big Data and the key implementation technologies.

- Finpro ry, collecting gathering Big Data companies in Finland.
- Tieke ry, Establishing a Finnish Big Data forum.

- DIGILE Oy Big Data research programme D2i. The "Data to intelligence" (D2l) SRA is focussed on knowledge pools and this SRA is being led by Tieto. D2l program is focused on Big Data, data reserves and user-centric service development (https://www.elettra.eu), (http://company.nokia.com/fi).

Google Trends

The interest over time in Finland indicate the interest of Big Data started in late the middle of 2012, see figure 9 as follows:

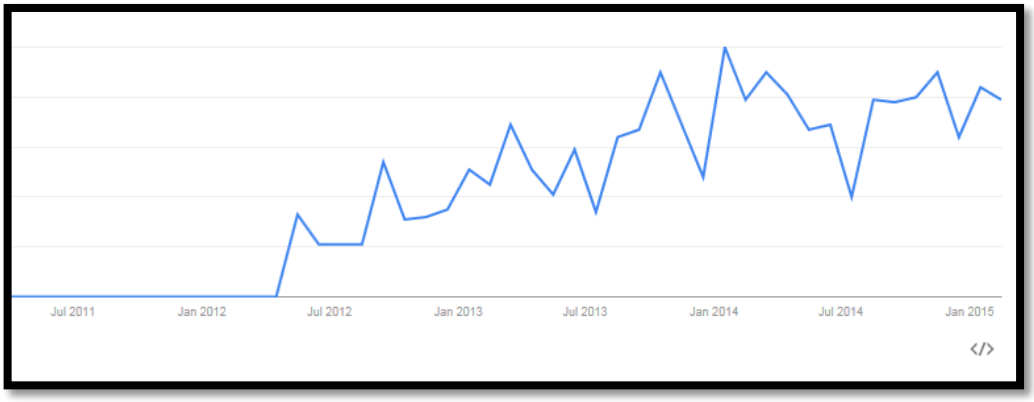

Figure 9. Big Data interest over time in Finland between 2011 – 2015 (google.com)

Big Data Regional Interest in Finland as per Google trends shows the interest mainly is concentrated in Helsinki region, see figure 10 as follows:

Figure 10. Big Data Regional Interest, March 2015 (google.com)

Networked Readiness Index 2014:

The Global Information Technology Report (GITR) and the Networked Readiness Index (NRI) released by The World Economic Forum's in 2014 under the theme, "Rewards and Risks of Big Data". The report presents the latest findings of the NRI measures the capacity of 148 economies to leverage ICT for growth and well-being.

The Networked Readiness Index measures, on a scale from 1 (worst) to 7 (best), the performance of 148 economies in leveraging information and communications technologies to boost competitiveness and well-being.

For a second consecutive year, Finland tops the rankings with a strong performance across the Board and availability of the latest technologies. It ranks 1st in the readiness sub-index thanks to an outstanding digital ICT infrastructure and 2nd in both the usage and impact sub-indexes, with more than 90 % of its population using the Internet and high levels of technological and non-technological innovation. The country also comes in 3rd in the environment sub-index, with a very robust innovation system, see table 2 and figure 11 as follows:

Rank	Country	Value
1	Finland	6.04
2	Singapore	5.97
3	Sweden	5.93
4	Netherlands	5.79
5	Norway	5.70
6	Switzerland	5.62
7	United States	5.61
8	Hong Kong SAR	5.60
9	United Kingdom	5.54
10	Korea, Rep.	5.54

Table 2. The Networked Readiness Index 2014 (weforum.org)

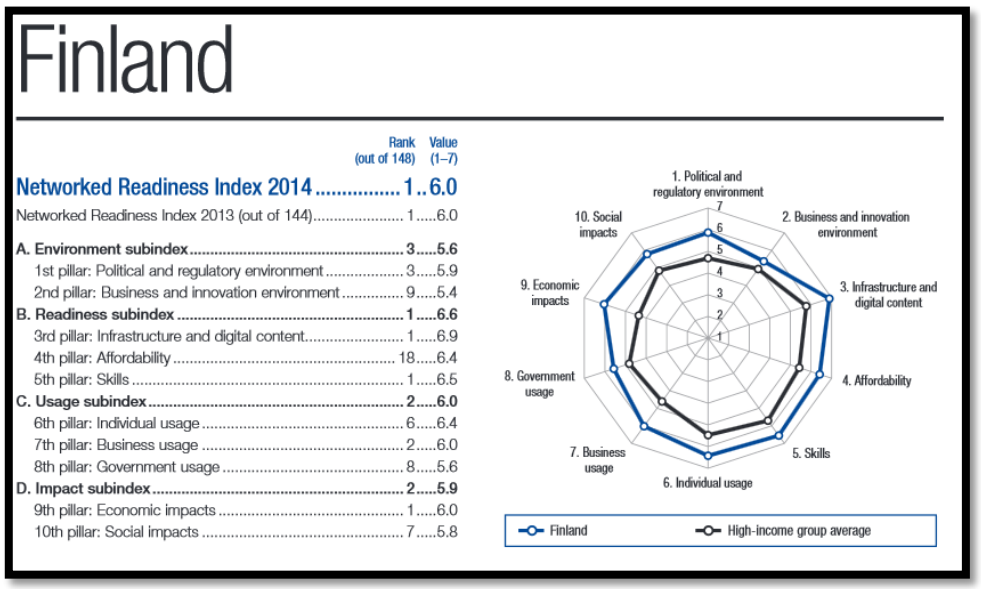

Figure 11. Finland Networked Readiness Index 2014 (weforum.org)

This report confirms that Finland does have well-developed environmental and ICT infrastructure to support the idea to adopt Big Data strategy and even take a leading role (http://www.weforum.org).

2.10 Conclusion

It is clear that the Big Data hype has reached Finland and it already started to take shape but in a slow pace. There are number of early adopters and initiatives from public and private sectors which indicate the level of interest.

Big Data is recognized as a very important new technology and a national strategy according to the Ministry of Education and Culture in Finland and by 2017, Finland is aiming to become a leading country in the openness of science and research.

Big Data clearly open new horizons and opportunities and the real impact still years away from now. But Big Data raises serious questions, too, about how we protect our privacy and other values in a world where data collection is increasingly ubiquitous and where analysis is conducted at speeds approaching real-time.

Next, I move on to chapter three to present the central literature I used for this study.

3 CENTRAL LITERATURE ON THE FIELD

In this chapter I am presenting relevant literature linked to my study. It is about a young research area and I have noticed that the variety of literatures are quite limited and fresh in comparison with other subject fields. I mean the literatures are from 2005 and up to now. The literatures often describing things and ways of seen the phenomena but the paper analyses is hard to find. This is perhaps due to youngness for the research field.

I have found both book and interesting articles and journals related to my study area.
In the following section I am presenting shortly essentials for my study and the order is that I start with a few books and then journals and papers.

3.1 Central books about Big Data

When I started study about Big Data I came across a number of books and the most relevant and interesting to my study area was written by, *Thomas H.Davenport, Viktor Mayer-Schönberger and Kenneth Cukier, Mark van Rijmenam, Evan Stubbs*.

Davenport discusses in his book (Big Data @ Work, 2014) about his study on Big Data and the interviews he made with high profiles in big companies like, UPS, GE, LinkedIn, Amazon, United Healthcare and many other to understand their experience on the technology as early adopters. He also discusses Big Data in general and showcase his study outcome on how to develop a strategy and a plan of action regarding Big Data, what skills a data scientist needs and how Big Data will change traditional management behaviours. He covers the bases and the key success factors in implementing any Big Data project.

Davenport´s study focus has been limited within US and does not mention anything in his book about Big Data trends and readiness in other countries and in our case he does not mention anything about Big Data in Finland.

Viktor Mayer-Schoenberger & Kenneth Cukier on his book (Big Data: A Revolution That Will Transform How We Live, Work and Think, 2013) explores how the data explosion is touching every facet of our lives. The authors argue that people to really understand

the real value of data and the insight and changes it brings to our lives. They focus in this book on more into the values and futuristic impacts that Data can bring in to our day to day life. They claims that data can protect us from future diseases and, overhauling our retail experiences and transforming every industry. They give readers a fascinating survey of Big Data's growing effect on just about everything: business, government, science and medicine, privacy and even on the way we think. The book correctly points out that data is rapidly becoming the "raw material of business". The most important part of the book is the authors' discussion of potential risks and possible ways to address them.

There is, of course, a dark side to Big Data and the authors provided argument and analysis of the dangers they foresee. Privacy has become much more difficult to protect, especially with old strategies. The second danger Mr. Cukier and Mr. Mayer-Schönberger worry about in which predictions seem so accurate that people can be arrested for crimes before they are committed.

The authors describing the future and potentials of data and Big Data technology on high-level and they do mention anything about Big Data in Finland.

Same story with the other books, they are more or less diving into the business values of Big Data, the impacts and changes Big Data technology can bring to the organisation and society. None of them address anything about whether Big Data hype has reached Finland or not.

3.2 Journals and paper

During my study I came across many journals and papers discussing about different aspect of Big Data, but only a few of them was referring to Big Data hype in Finland and assessing the readiness for adoption and maturity level nationally. Following are the most important studies that took place by researchers in Finland:

- **Big Data exploitation:** Big Data strategy proposal by, Finnish Ministry of Transport and Communications, 2014.

  This paper is one of the most comprehensive work I came across during my research. This proposal has been developed by a group of Finnish researchers established by

Finnish Ministry of Transport and Communications. The working group was set up for the purpose of formulating a vision and determining national development measures for exploitation datasets more effectively in different sectors".

The paper presents a draft national strategy for exploiting Big Data, including national policies for achieving this. The draft strategy presents an overview of the current position regarding large datasets in Finland and identifies potential application areas of relevance to Finland.

Among many other areas the report provides answers to many questions about Big Data and the use of Big Data in Finland. It has identified and prioritised the application areas for exploiting Big Data that are of significance to Finland including, Health, Intelligent infrastructures, Research, Transport, Clean technology and Public sector as application area for Big Data (http://www.lvm.fi).

- **Accenture studies on Big Data hype in Finland and globally.**

  As I mentioned in chapter 2.6, Accenture presented the results of two researches about Big Data hype on global level and specifically in Finland:

  1. Research on Finnish businesses and organizations, January 2014.

     I have presented the consultation of this study in chapter 2.8

  2. Big Success with Big Data research report, September 2014

     This study presented data on executive's satisfaction level from companies that are applying Big Data to their businesses. In this survey companies from seven different industries and 19 countries, including Finland. Almost all 98 % in its operations that make use of Big Data Finnish companies are satisfied with the results and 82 % to keep the Big Data is a very important part of the business to digitalisation (http://www.accenture.com).

- **The Global Information Technology Report 2014 by World Economic Forum.**

  As I mentioned in chapter 2.7 the 13th edition of the Global Information Technology Report provides a comprehensive assessment of networked readiness, or how prepared an economy is to apply the benefits of information and communications technologies (ICTs) to promote economic growth and well-being. This edition also analyses in detail the rewards and risks associated with Big Data and what public and private organizations must do to benefit from it.

  Finland tops the rankings with The Networked Readiness Index and components sub-index (the environment for ICT offers by a given country, the country's readiness to use ICT, the usage of ICT among key stakeholders and ICT´s impact on the country. Based on this facts and figures as well as analyst's statements, Finland remained stable as a top performer together with other Scandinavian countries by taking the right step to leverage the most out of ICT and having the readiness for adopting new technologies as Big Data (http://www3.weforum.org), (http://global-indices.insead.edu).

- **Aalto University Magazine focuses on Big Data.**

  Aalto University Magazine 10, examines the concept of Big Data: what it refers to, what it used for and whether there is reason for concern (http://www.aalto.fi).

3.3 Seminars - webinar

In 2014 a few seminars on Big Data took place and here is a brief overview about the content

- **ICTExpo 2014 , on Big Data and Hadoop, (by Immo Salo - Ivorio oy - 07.05.2014)**

  Ivorio's Immo Salo took the stage on ICTExpo 2014 with the keynote topic of "Big Data and Hadoop". He started to explain the basics of Big Data concept and what is the attributes of the Big Data and what the 3v means. He also got in touch with sources that generates data and expansion pace. He also explained the utilization of

Big Data and the illustrated the basic of Big Data architecture, tools and technologies for managing and processing and analysing it like Hadoop and the some ecosystems.

The purpose for this seminar mainly was to promote for Big Data concept locally and networking with stakeholders and technology enthusiasts and give the message that Big Data has reached Finland and we are here to provide education and solutions in this space (http://www.ivorio.fi).

- **Haaga-Helia Seminar on Big Data and the Financial Services Sector, 12 May 2014**

  This seminar on Big Data is intended for financial industry representatives, project partners, students and teachers interested in the field of Big Data analytics and financial services.

  Invited experts like Matti Vakkuri, Director at Tieto discussed various perspectives on the importance of Big Data for the Finnish and global Economy. According to Mr. Matti Big Data will revolutionizing all industries and improving life standard in almost all different aspects around us as healthcare, education, energy consumption, transportation etc. Jonas Slördahl Skjerpe Executive Director at EY talked about the Big Data Opportunities in the Financial Sector. Taru Rastas, Senior Adviser, Ministry of Transport and Communications talked about Data Development in Finland. A key message on this seminar was clearly that Big Data started to be cultivated in the Finnish industry and society and stakeholder starts to discuss the approaches and opportunities (http://www.bigdata.fi).

3.4 Sources in Finland

Clearly there is lack for literatures and studies by Finnish researchers about Big Data in and its impact to the industries in Finland. The level of Big Data related activities happening in Finland are fragments of publications, seminars and a limited numbers of studies and reports from a number of companies, organisations and universities.

The outlook in Finland regarding Big Data seems to take lift but slowly and I believe it still take a while to form a solid shape. New projects and initiates will pop up and other will fall out until the technology get the maturity and a specific trend and shape fit into Finland´s ICT and business environment.

3.5 Conclusion

Even though Big Data is a young topic, I see there are good amount of literature including books, journals and papers on the global level. Nevertheless, the case in Finland is different and Finnish literature related to Big Data is hard to find.

However, I see it as fragments of sources and there is no solid ground or clear footprints yet. What I see there is a wide variety of approaches and strategies by leading organisations and developers which makes it hard to find the track. Yet, people having unified views in relation to the main concerns, like privacy and data security issue, importance of the objective, vision and solid strategy.

In the following chapter, I will give an overview of the most utilized tools and technologies linked to Big Data.

4 TOOLS AND TECHNOLOGIES FOR BIG DATA

Big Data architecture and analytics become possible as the core of Big Data technologies emerged in the market e.g., Hadoop and MapReduce. Big Data landscape can be overwhelming due to vast variety of tools and technologies available in the market which is called Big Data ecosystems. I will shortly describe some of the solutions below.

It might be quite tempting when you look at the prices of the technologies in the market as they are either free (as with open-sources software's) or relatively inexpensive (as with commodity servers). The tools are only one piece in the puzzle and it neither resolve our problem nor help us to achieve our objectives.

The downside is that Big Data technologies are relatively labour-intensive to architect and program in one hand, in other hand the high costs must be spent in planning and operational aspects. Prior that, in the first place companies must spend time and resources on developing a well-designed Big Data strategy with clear vision and objectives. Also the organisation need hire expensive Big Data expertise and provide required training to the dedicated internal staff within Big Data organisation.

The planning and operation require a lot of attention from the dedicated personnel, expertise and the management team. Today and for the foreseeable future, there are many new technologies to choose from and you and your organisation must do some studying to avoid making bad decisions.

4.1 The Big Data Stack

To understand Big Data, it helps to see how it stacks up to overview the typical components of the Big Data stack. Each component of the stack is optimized around the large, unstructured and semi-structured nature of Big Data. Working together, these moving parts comprise a holistic solution that's fine-tuned for specialized, high-performance processing and storage, see figure 12 as follows:

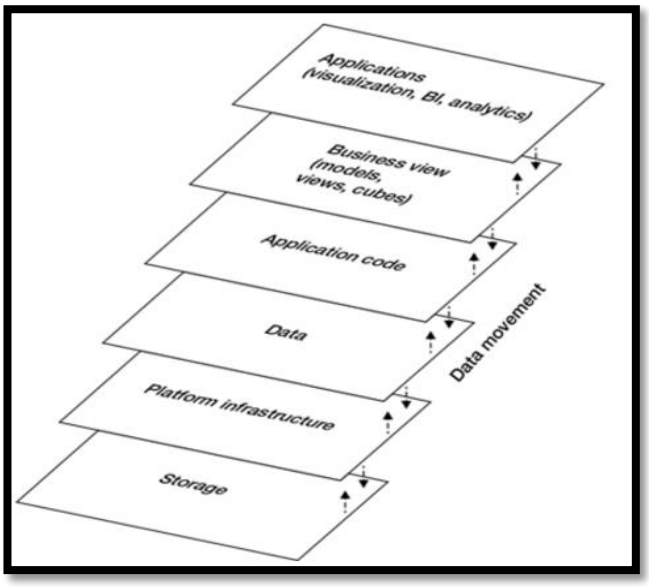

Figure 12. The Big Data Stack (Davenport, 2014, pp 119)

Big Data stack typical component according to SAS best practice 2013:

1. **Storage:** Big Data storage distinguished with the low cost. Storage in Hadoop environments is typically on multiple disks attached to commodity servers and storage solutions like EMC can be added quickly and cheaply.

2. **Platform Infrastructure**: Infrastructural technologies are the core of the Big Data ecosystem. The Big Data "platform" is typically the collection of functions that contain high-performance processing of Big Data. Typically, Big Data platforms include a Hadoop and NoSql.

3. **Data**: The data layer in the stack implies that data is a separate asset, demanding discrete management and governance.

4. **Application Code, Functions and Services**: In this area Hadoop Mapreduce stand out, as this is the framework that is used for processing significant amount of data in parallel. Hadoop uses a processing engine called MapReduce to not only distribute data across the disks, but to apply complex computational instructions to that data. In keeping with the high-performance capabilities of the platform, MapReduce instructions are processed in parallel across various nodes on the Big Data platform and then quickly assembled to provide a new data structure to be ready for the next phase of the Big Data treatment.

5. **Business View**: This layer of the stack makes Big Data ready for further analysis. Depending on the Big Data application, additional processing via MapReduce or custom code might be used to construct an intermediate data structure, such as a statistical model, a flat file, a relational table or a data cube. The resulting structure may be intended for additional analysis or to be queried by a traditional SQL-based query tool.

6. **Applications**: In this layer, the result of Big Data processing are analysed and displayed either by business users or by other systems using them to make automated decision. The analyses of Big Data is not so different from traditional data analyses, except that it is more likely to be done with machine learning, faster processing tools like in-memory and high-performance analytics environment and visual analytics (Davenport, 2014, 119-124).

4.2 Tools and platforms are used in Big Data

- **Analytics Platforms:** Although infrastructural technologies incorporate data analysis, there are specific technologies which are designed specifically with analytical capabilities in mind. The platforms Integrate and analyse data to uncover new insights and help companies make better-informed decisions.

- **Business Intelligence (BI) Platforms**: Used for integrating and analysing data specifically for businesses. BI Platforms analyse data from multiple sources to deliver services such as business intelligence reports, dashboards and visualizations.

- **Visualization Platforms:** Visual analytics, Display of analytical results in Visual or graphic formats. Presenting it in complex, multi-dimensional visual formats to illuminate the information.

- **Machine learning:** It falls under the analytic type of softwares but is dissimilar to the others. Whereas the analytics platforms input processed data and output analytics/dashboards/visualisations for end users, the input in machine learning is data the algorithm ‘learns from’ and the output depends on the use case.

- **Hadoop:** Open-source software for processing Big Data across multiple parallel servers. It is a set of algorithms (an open-source software framework written in Java) for distributed storage and distributed processing of very large data sets (Big Data) on computer clusters built from commodity hardware. Hadoop started out as a subproject of Nutch created by Doug Cutting. Hadoop sometimes called Apache Hadoop, because the most common version of it is supported by The Apache Software Foundation. However, as many commercial vendors have created their own version of Hadoop as well. There are Cloudera Hadoop, EMC Hadoop, Mircosoft Hadoop and many more.

- **MapReduce:** Hadoop MapReduce is a software framework for easily writing applications which process vast amounts of data (multi-terabyte data-sets) in-parallel on large clusters (thousands of nodes) of commodity hardware in a reliable, fault-tolerant manner.

- **In-memory analytics**: Processing Big Data in computer memory for greater speed.

- **NoSql**: Stands for Not Only SQL; also involved in processing large volumes of multi-structured data. It is a database providing a mechanism for storage and retrieval of data that is modelled in means other than the tabular relations used in relational databases. Motivations for this approach include simplicity of design, horizontal scaling and finer control over availability.

- **Hadoop Distributed File System (HDFS):** HDFS is a file system designed for Large-scale distributed data processing under MapReduce. It is highly fault-tolerant and designed to be deployed on low-cost hardware. HDFS provides high throughput access to application data and is suitable for applications that have large data sets.

- **HBase:** It is a non-relational distributed database storage system for Hadoop HDFS. It is for backing Hadoop MapReduce jobs with Apache HBase tables.

- **Apache Pig:** It is a platform for constructing data flows for extract, transform and load (ETL) processing and analysis of large datasets. Pig Latin, the programming language for Pig provides common data manipulation operations, such as grouping, joining and filtering. Pig generates Hadoop MapReduce jobs to perform the data

flows. This high-level language for ad hoc analysis allows developers to inspect HDFS stored data without the need to learn the complexities of the MapReduce framework, thus simplifying the access to the data.

- **Hiv:** It is a SQL-based data warehouse system for Hadoop that facilitates data summarization, ad hoc queries and the analysis of large datasets stored in Hadoop-compatible file systems (e.g., HDFS, MapR-FS and S3) and some NoSQL databases. Hive is not a relational database, but a query engine that supports the parts of SQL specific to querying data, with some additional support for writing new tables or files, but not updating individual records (Davenport, 2014, 113-118), (http://en.wikipedia.org), (http://hadoop.apache.org).

4.3 Conclusion

As we see even though we are in the early stages of Big Data era but the variety of tools and platforms are overwarming and complex. It requires thorough study to understand the landscape. So far we can see software e.g., Hadoop and MapReduce are most popular and well-established core technologies in Big Data space. On tops of that the wide variety of ecosystems are out there to offer solution to a specific problem area within Big Data environment with unique features e.g., visualization, real-time analytics, machine-learning etc. But the main issue comes down to the execution.

In the following chapter I will present the empirical part of the study and I will describe the results from my field research.

5 FIELD RESEARCH

In this chapter I will describe the empirical part of the study. I will use the knowledge I learned from the theoretical part as a base for the field research. Going forward the key findings will be listed in a questionnaire form and will be directed to target groups in different industries. The data from feedbacks will be collected, processed, analysed and illustrated.

5.1 Methodology

The methodology I use for the field research is a qualitative method. There are a number of reasons for using this method which is mainly linked to the purpose of my study and what we want to achieve out of it.

Argument for using the qualitative method.

The relation between the purpose of this study and using qualitative research method is solid. The first purpose of this study was to conduct a research about Big Data technology trend and maturity level in Finland. The second purpose is to recognize and understand the impact factors on industries to adopt the technology.

The purpose of qualitative research generally is to explore the participants view and experience in the subject that is the phenomena being studied and it is used when we don't know what to expect. Multiple type of data and observations are collected from the participants from the statements they made, the way they experience the technology, the numbers and rating indication they gave in the survey.

In qualitative research, only a sample of a population is selected for any given study and the focus is on a much smaller group. It enables the researcher to focus in the subject in-depth. Researcher's time and resources is another factor which plays a role in defining the size of the sample pool for data-gathering. Here, data will be collected through surveys (online, phone, paper). The questions in the qualitative survey are open-ended questions and gives participants the opportunity to respond in their own words and the questions. These are the most essential factors which make it ideal chose to use to use qualitative research method (http://en.wikipedia.org).

5.2 The combination of the theory and field information

I have chosen to conduct a series of interviews on the field. I have selected 10 business companies and organisations to interview a number of people on senior management and executive positions. The target group was mainly with ICT Technology, Communication and Manufacturing industries.

The field research took place in the Southern of Finland started from January to March 2015. As a qualitative research method I was able to do the interviews by sending the survey electronically to the participants and over the phone.

5.3 Is my study valid and reliable?

Based on literature theory I worked out a questionnaire with 10 essential questions, see appendix 1. I have tested the questionnaire and reached out the respective people in companies to get their answers.

As I received the answers from the companies I collected the data and analysed every single one of them. Then, I illustrated the result on Excel based table and chart figures.

It is hard to say something definite or generalize the data based upon this small amount of responses. Nevertheless the samples are taken from the field and it provides indeed a basic insight about the stat and trends of Big Data technology in Finland.

5.4 What did I miss?

It is a fact that my study indeed can´t be compared with Accenture's study. My study is very narrow and the despondence was on 10 from specific industry segment and that is due to resource limitations. Thus, I could not cover a larger group to get more comprehensive data from the field.

The response rate for the survey was about 30 % from different companies and industries. Missing data from some industries and people were one issue that can be highlighted. Nevertheless this will not have a major impact to my purpose and the final conclusion.

5.5 Key findings

I surveyed over 10 decision makers in 10 different companies and organisations in different industries across Finland. The survey feedback has been received, the data has been collected, processed and analysed.

Even though the target group was very small and amount of collected data is a sample.
I found in this study an insight and clear indication about the current state of Big Data in Finland. I also found participants perspective and concerns regarding the technology. The data represents a group of stakeholder's opinions from specific type of Industries in Finland.

The result of the research has provided the answers to the essential questions that has been raised and identified for purpose of the study.

Based on the results, Big Data clearly has reached Finland and it is very much appealing and important for specific industries which possess a lot of data like Communication and Information technology companies. Next is Transportation, Manufacturing and Power services.

In other hand Big Data concept today still seems to be uncommon alike other well-established technologies in Finland e.g., cloud and mobile technology. For conventional businesses and small companies the concept is not relevant and they do not have plans to adopt Big Data strategy in the near future.

Early adopters and initiative takers are very much specialized industries in high level ICT and BI technology, R&D and sciences. The most common reason of adopting it is to stay on top and remain competitive and innovative in the business.

Some of participants believe that Big Data alone is not enough, but it will be a game changing paradigm when one combines it with other technologies like Internet of Things (IoT) and Cloud. The majority stated that the tools and solutions are in still in early stages, but absolutely worth the investments, but it also depends on your plan and what you want to achieve.

5.6 Survey questionnaire and the results

I am presenting my results in the same order as the survey questionnaire is listed.

- **Big Data Impact on the business**

1. Do you think Big Data will have a revolutionary impact on your business and the lifestyle of the society in Finland?

   The vast majority 60 % of all participant strongly agree and 40 % agree with the revolutionary impact of Big Data on the business and lifestyle of the society in Finland. There are no records from this segment of industry and people disagree with it, see figure 13 as follows:

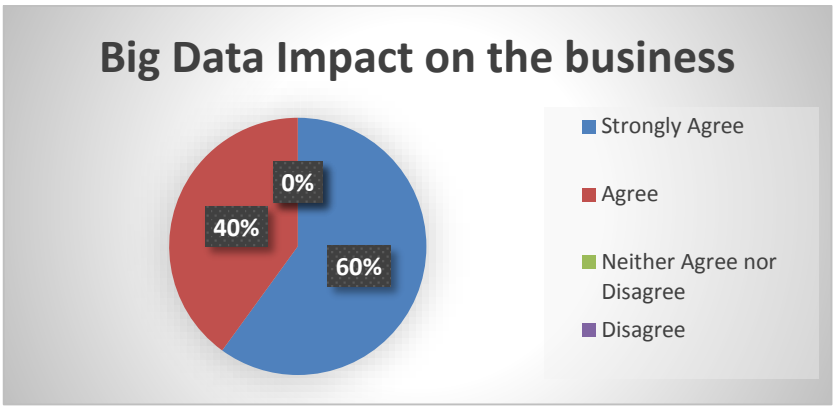

Figure 13. Percentage of Big Data Impact on the business (Barzingi 2015)

Comments from the participants:

"Big Data alone does not maybe do much on societal level, but together with other parts of digitalization they will drive a major change".

"Although there is a lot of hype currently, in the long run for example new data-based models and technologies will have a profound impact on the economy".

- **Big Data technology adoption**

2. When do you expect Big Data will impact your business?

Big Data Technology already impacted 70 % of the companies which responded to the survey. 30 % indicated that will impact in less than 3 years, see figure 14 as follows:

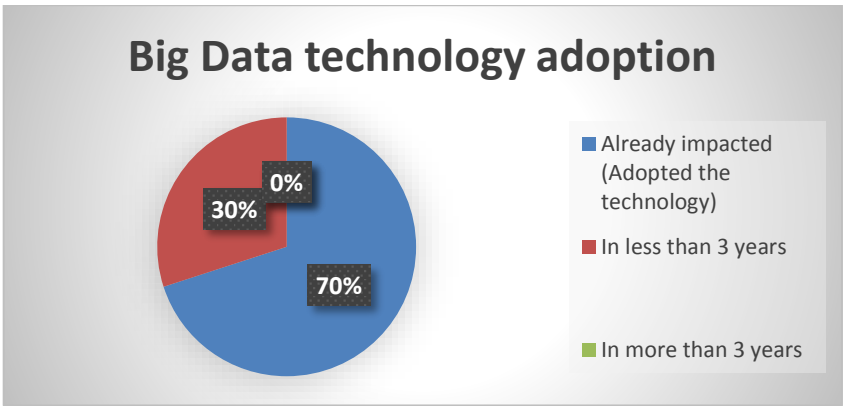

Figure 14. Percentage of Big Data technology adoption (Barzingi 2015)

Comments from the participants:

"Limited adoption this far. Only for internal use at this stage – product development, customer experience. No new radical business models at this stage".

"Currently there are not too many specific Big Data use cases in the public sector".

- **Importance of Big Data**

3. How important is Big Data to your organization?

The majority of the participant consider Big Data is extremely important for the organisation 70 %, while there are no records from any participant to indicate the opposite opinion, see figure 15 as follows:

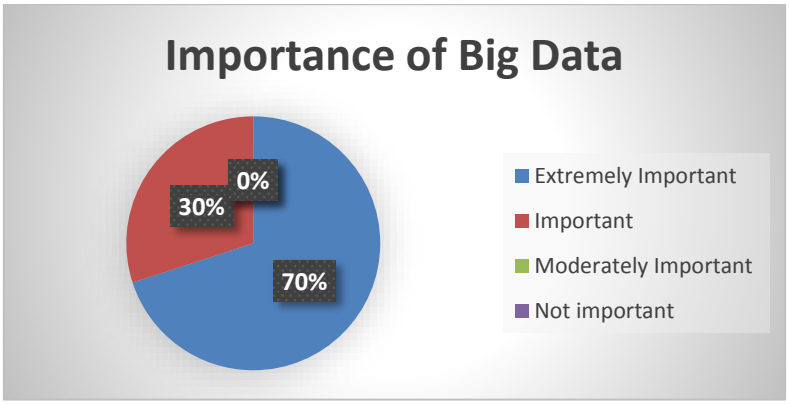

Figure 15. Percentage of the importance of Big Data (Barzingi 2015)

Comments from the participants:

"Telecom operators have a lot of data which can be analysed for various purposes".

"Big Data and modern analytics are the core business concepts in our company".

- **Main challenges with Big Data projects**

4. What are the main challenges to adopt Big Data in your company?

The feedback shows that the companies facing multiple challenges while adopting the technology. Equal 25 % of the stake goes to Data security and privacy issues, Lack of expertise and Intergradation with the existing system. 15 % of the participants consider Big Data technology is not mature enough, while equal 5 % of participant consider budget is an issue and the company is not ready to adopt Big Data, see figure 16 as follows:

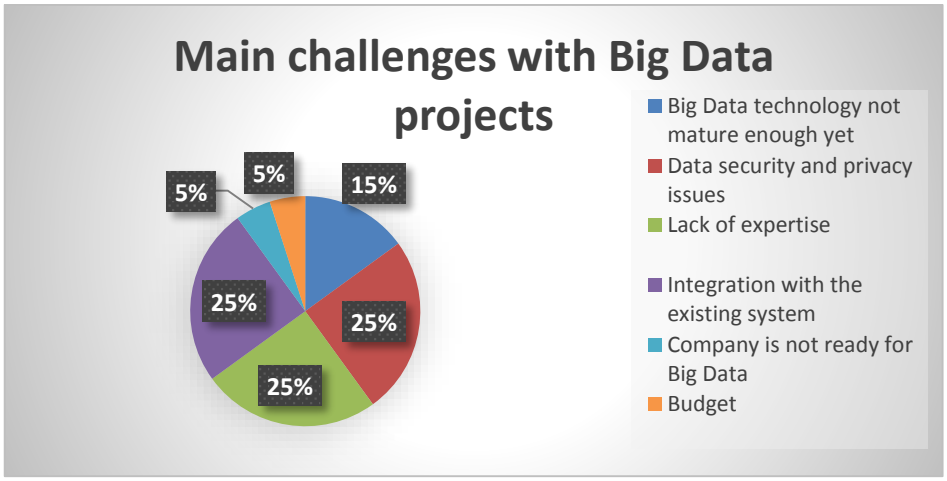

Figure 16. Percentage of the main challenges with Big Data projects (Barzingi 2015)

Comments from the participants:

"From technical expertise point of view the biggest challenges are in rapidly changing product portfolio and potential customer's trust in the enterprise readiness of these (along with growing number of cloud based services within)".

"Estimations on bottlenecks of Big Data adoption based on strategy work & feedback we have received. Probably the most crucial bottlenecks are related to skills (lack of expertise and supply of new professionals) and awareness of".

- **Potential for transformation**

5. Where will Big Data have the biggest impact on your organization in the next five years?

It seems companies' objective for adopting Big Data is mainly for Innovation and development purposes. 37 % of the participant indicated that the biggest impact on the organisations in the next five years will be on innovation and development. 26 % claimed that Big Data fundamentally will change the way they do business. 16 % on customer relationships, while only 11 % for cost reduction and 10 % for time reduction, see figure 17 as follows:

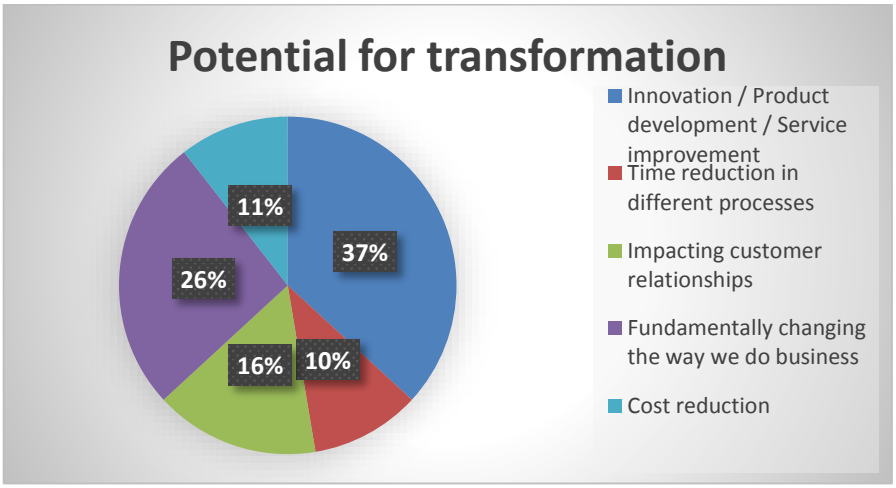

Figure 17. Percentage of the potential for transformation (Barzingi 2015)

Comments from the participants:

"At best Big Data will have a crucial role when businesses are shifting to a more service-oriented direction. Collection and analysis of data will enable companies and public sector to come up with new models".

"For us as consultants it's more about the maturity of technologies and best practices. Our customers will then benefit in various ways from the business improvement".

- **Answers to the open questions:**

6. What is your perspective about Big Data?

- It's a game changing paradigm. Combined with digitalization of society and emergence of cloud services, Big Data will change the way we measure everything and analyse our business.
- Materials data repositories, computational discovery and analytics, machine-learning techniques etc.
- I believe that it will change the way we do business and help us to create new business models and considerably enhance our customer's experience.
- Data will have important value in future. And the one that have access to information and can combine both internal and external data will have strong position
- Needs to be connected with Internet of Things (IoT), automation and robotics (digitalization).
- It is a big challenge for official statistics. We are nationally and internationally well-connected to our Big Data R&D environment in general.

7. Do you think Big Data technology ecosystems are mature enough to invest in?

- They're in their infancy, but absolutely worth the investments. The trend is towards open source and skills improvement within the workforce, so it's not only about Big Data technologies but more of a larger attitude change. Need to accept a rapid change in technologies, tools and architectures.

- Yes and quickly evolving. Depends on what do you want to achieve.
- Yes. Probably already a bit late.
- I think they are already on the level that they can truly help/contribute in decision-making. Naturally they will develop all the time, but to succeed one needs to proceed with it.

8. What is your vision to overcome Big Data challenges? (Example: Data privacy protection, Staff skills upgrade, hiring expertise, etc.)

- There will be tools, practices and guidance on the biggest challenges, since they're well known from legacy architectures. Early adopters are taking more risk, but have bigger chance for benefits.
- For us Big Data is a research platform in materials sciences and nanotechnology. Our challenge is to develop new algorithms and methodologies for data-intensive computing. We need bright graduate students and postdocs to help us.
- Lack of staff skills is the biggest obstacle. Hiring new competencies and the development of existing staff is a key. Another issue is a limited overall and especially company management awareness. Big Data is still largely viewed as an IT and analyst sandbox not as a major business value enabler.
- Start with smaller steps and manage the risks.
- Good cooperation and partnerships, staff skills upgrade, hiring expertise, intensive participation in international Big Data work.
- There are several factors: need to optimize, regulations need to keep and access data. Especially in Finland we have a "fat cat" problem. There is no urgent need to seek innovative solutions in order to survive in serious competition.

9. Please describe the main concerns and obstacles to adopt Big Data strategy.

- Awareness of the change in general. Data-driven business culture requires understanding from every level in the organization. It's not a technological change, but a change of working culture.
- Outside academia, the big challenge is probably lack of expertise.
- To see the opportunities beyond current business models. Business case will not be visible in first steps.

- Availability of skills is currently a crucial problem. Oddly enough, there is a lack of supporting data. Information and research that would help decision and policy makers isn't easy to find. Clear rules and practices on for example Data protection would clarify some issues related to processing Big Data, including Big Data used for research.
- Resistance and slowness from stakeholders.
- Legal obstacles, data sources can be useless in the end, Big Data are collected for other purposes than official statistics and Big Data source might change (e.g. social media).

10. Please describe the main reasons encouraged you to adopt / consider to adopt Big Data strategy.

- The enormous wealth of possibilities for business improvement and new innovation.
- Computational methods enable systematic search for new materials and structures relevant for nanotechnology – this would be impossible without "Big Data".
- Big Data is inherent in research work and cannot be ignored.
- Will enable growth in totally new areas of services to customers
- Finland and the EU are lagging behind (compared to US) in data driven business and Big Data use. Thus a more coherent approach, strategy and co-operation of the governments and businesses are needed to catch up with competitors. Big Data and data are cornerstones of digital development. With the appropriate investments and focus, Finland could be at the forefront of this development: we have strong expertise in methods, data processing and information technology and high-quality data reserves. In order to exploit Big Data, these strengths must be put to use in different areas of application and in a multidisciplinary manner.
- Part of our product development as an IT platform provider.
- In order to stay and be on top. You need to be able to build a data driven strategy. This obviously includes Big Data in it.
- Without making use of the Big Data one cannot be competitive on international market.

Other comments:

- The output of data increases in every business sector and will provide a wealth of possibilities for analytics over larger and more complex datasets for both business improvement and new business innovation.
- Computational science (processing "Big Data") is already part of many if not all key research areas of the university. It has and will have a strong impact on society, not just in Finland, but globally.
- Much research is data-intensive quantitative research. Big Data cannot be ignored in current research (in any field).
- Our research will benefit from Big Data the most. To some extent our second core area, teaching, may also benefit.
- Big Data will give rise to changes in the future that we even cannot imagine today.
- We do not have such security and privacy issues here but they can prevent us from getting Big Data into this organization (e.g. private data holders, mobile data due to the legislation on telecommunication).

6 MY GUIDANCE FOR NEW PROJECTS WITHIN BIG DATA ANALYTICS

The theoretical and empirical results of this study offered an insight about the possible theme and trends of Big Data in Finland. That being said, the outlook in Finland is that adopting Big Data is mainly for innovation and developments as the main objectives. The ICT environment, Open-Data and governments support and interest in the field is a strong enabling factor for researcher within the context.

As a result, I envision that Big Data as technology and mind-set need to be adopted not only by big companies but also by young generations and new starts-ups. What I mean is that thinking about Data as fuel and raw material for innovation and productive insights, especially with the available technological supports, is a great chance for researchers.

My recommendations for researchers are as follows:

a) Start small and be as specific as possible!
b) Define SMART objectives for the project!
c) Identify a small problem area within a field that you know!
d) Try to build a small team consisting of talents with key skills you need for the project!
e) Open a collaboration network for knowledge exchange!

Potential research projects within Big Data analytics:

My recommendations for potential research projects are as follows:

1. Big Data analytic for new innovators and entrepreneurs!
2. How to find and collect clean and trusted data for analytic and innovation purposes!
3. Looking for new insight from a small practical Big Data analytic project!

7 CONCLUSION

It is clear that the Big Data hype has reached Finland but at a significantly slower rate than other countries like USA, India and East Asian countries. The concept is still uncommon for general public but certainly well-known for researchers, specialized and high-tech companies rather than ordinary businesses.

During the research I found out limited number of Big Data related activities as seminars, workshops, papers and journals. It seems that the trends moves on but with caution due to concerns and obstacles e.g., Data security, lack of expertise and use cases on the national level.

One of the significant steps in Finland is that a National Big Data strategy proposal that is now in place which has been developed by a working group from the Finnish Ministry of Transport and Communications. The report contains comprehensive details about Big Data in Finland focusing on policies and measurements that would enable companies and public sector to better exploit Big Data.

The empirical research gave not only the records of the patterns and trends within the industries, but also the explanation for the slowness. It seems the issue is not about the technology itself, but it is about the perception and resistance for change in general. No one made a clear statement against it but the matter of avoiding the subject is simply caused by lack of knowledge and real need for it.

However, based on the facts and figured that been collected Big Data Technology is to be extremely important for High-Tech companies´ business development, innovation and strategic purposes. They also stated that the technology application is restricted at the moment though. The technology already impacted 70 % of the companies from that industry segment and 30 % having a plan to adopt it in less than three years.

Finland has one of the best ICT infrastructure and the environmental support system and readiness for the latest technology in addition to talent and possibility to grow skills and expertise. This lead to the conclusion that Finland is ready to be one of the leading developer actors in the area.

7.1 Did I reach my purpose in my study?

The main question of this study was Big Data – a Hype that has reached Finland or not? The purpose was to assess Big Data technology trend and maturity level in Finland and to recognize and understand the impact factors on industries to adopt the technology.

Yes, the theoretical and empirical part of the study provided the answers to these questions from the data that has been collected and the statements that has been made by participated actors in the study.

7.2 What is my contribution, theoretical or practical contribute?

In many study the results are about two things. Firstly, my personal learning curve was tremendous on Big Data theme. The knowledge I learned opened new horizon and interesting insights.

My theoretical contribution is that Big Data technology in cooperate with other technologies could help young generations and researcher to gain great innovative insights.

Secondly, the contributions to companies and society in general is to get prepared for new emerging competitors that are using big data as technology for faster and proactive decisions and making better and low cost innovative products and services. Based on my finding apparently some of the industries already has started using the technology in a limited manner and my conclusion is that this is an indication that the trend of Big Data has landed and already taken place for expansion. The risk for failing is big for any company in the face of global completions. To remain on the market is no longer about being big, strong and confident, it is about the speed and being agile.

If companies and researchers does not have enough data, you need to find and make data to gain new insight and competitive advantage through Big Data technology and data-driven culture. Defining clear objectives and developing reliable Big Data is the right step forward.

7.3 What is my answer to the topic?

When I started with this journey the topic was Big Data – a Hype that has reached Finland or not? Now when I look back and referring to the variety of sources I studied and the data I have been able to collect and can tell that YES, the hype has reached Finland.

My arguments for this statement are:

1. Company has started to adopt the technology. Other companies planning to adopt the technology in few years.
2. The majority of Business leaders knows about the technology and it is only a matter of time to evolve.
3. Finland has now a draft for Big Data Strategy and provides different type facilitations for more researches and innovations in the field.
4. Big Data subject in discussion forums, seminars and publications in Finland.

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APPENDIX 1

QUESTIONNAIRE IN MY INTERVIEWS

Please check in the box next to the right answer of the following questions, please add any additional comment you have in the "**Other comments**" area.

- **Big Data impact on the business**

1. Do you think Big Data will have a revolutionary impact on your business and the lifestyle of the society in Finland?

☐Strongly Agree

☐Agree

☐Neither Agree nor Disagree

☐Disagree

Other comments:

- **Big Data technology adoption**

2. When do you expect Big Data will impact your business?

☐ Already impacted (Adopted the technology)

☐ In less than 3 years

☐ In more than 3 years

☐ Not impact (No plans)

Other comments:

- **Importance of Big Data**

3. How important is Big Data to your organization?

☐Extremely Important

☐Important

☐Moderately Important

☐ Not important

Other comments:

- **Main challenges with Big Data projects**

4. What are the main challenges to adopt Big Data in your company?

☐ Big Data technology not mature enough yet

☐ Data security and privacy issues

☐ Budget

☐ Lack of expertise

☐ Integration with the existing system

☐ Company is not ready for Big Data

Other comments:

- **Potential for transformation**

5. Where will Big Data have the biggest impact on your organization in the next five years?

☐ Cost reduction

☐ Innovation / Product development / Service improvement

☐ Time reduction in different processes

☐ Impacting customer relationships

☐ Fundamentally changing the way we do business

Other comments:

- **Open questions:**

Please describe your view about the following questions:

6. What is your perspective about Big Data?

7. Do you think Big Data technology ecosystems are mature enough to invest in?

8. What is your vision to overcome Big Data challenges? (Example: Data privacy protection, Staff skills upgrade, hiring expertise, etc.)

9. Please describe the main concerns and obstacles to adopt Big Data strategy.

10. Please describe the main reasons encouraged you to adopt / consider to adopt Big Data strategy.

Other comments:
